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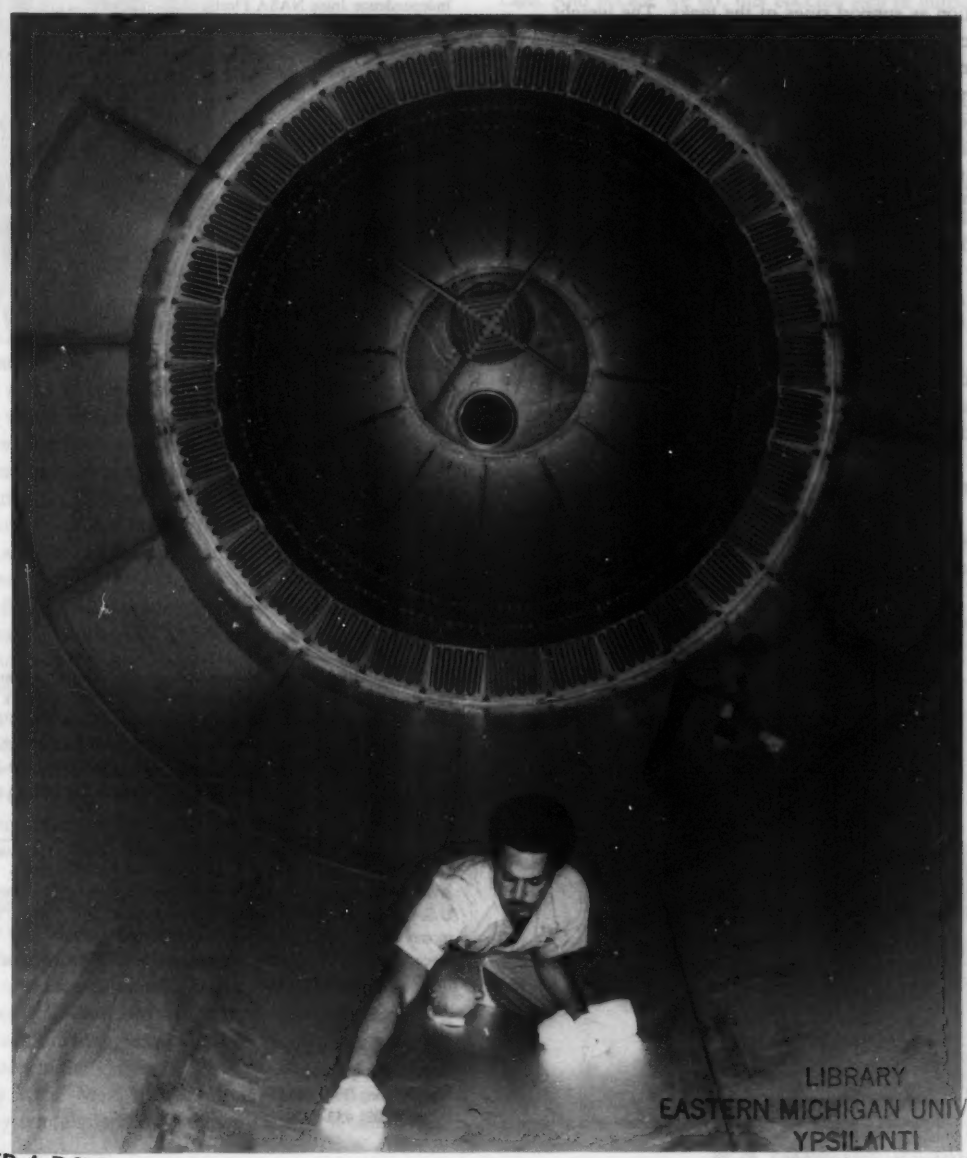

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About the Cover

Nearly dwarfed inside a giant Space Shuttle fuel tank, Martin Marietta technicians clean the tank's interior after pressurization tests. Behind them are new fuel slosh baffles which reduce the tanks weight by 630 pounds.

Close monitoring of fuel motion during early shuttle flights indicated to engineers at Martin Marietta's Michoud Division that the number and size of baffles could be reduced from eight to four. The baffles also function as support rings of the tanks. The weight reduction increases the shuttle's cargo-carrying capacity by nearly the same amount. Overall, Martin Marietta has reduced the tank's weight by 10,000 pounds. Martin Marietta manufactures the 154-foot long, 28-foot diameter external tank at NASA's Michoud Assembly Facility.

(Photo credit Martin Marietta)

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Administrator's Column

(In this column NASA Activities features an article by NASA Administrator James M. Beggs. These articles focus on subjects chosen by him that address topics of broad interest to the agency's employees. The column this month features an address presented at the National Air and Space Museum in Washington, D.C.)

The Quest For Mars

Mark Twain once said: "Predictions are very difficult to make, especially when they deal with the future."

I won't quarrel with that. But even if the immediate future is uncertain I have no doubts about the more distant years. So I'll make a prediction. It is that some day human beings will rove the surface of Mars. They will crate up those wonderful Viking machines, return them to Earth and send them here to this museum. And future generations of children will come here and stand before not merely one, but three Viking landers, and imagine their journeys and the adventures of the people that replaced them.

Apollo opened the floodgates of the human imagination to the exciting possibilities of people exploring the Universe. Science fiction became fact because we demonstrated conclusively that humans could indeed leave Earth, land on another world and return safely to their mother planet.

Now that we have opened those gates, humankind will never be the same. We will take many more steps on many more worlds before we're through. And one of those worlds, most likely the first we will go to, will be Mars.

Indeed, we could be en route to Mars before the middle of the next century. By then, using as our springboard the Space Station and its infrastructure, which will include an inter-orbital transportation system, we may well have established a manned lunar base. Mars would be the next logical niche for human expansion in the Universe.

Why Mars? Mars will have priority in any manned solar system exploration program because it offers the least severe environment for humans. Due to its atmosphere, its accessible surface, its probable availability of water and its relatively moderate temperatures—they range from –120° C to +20° C—it is the most habitable of all the planets other than Earth.

Moreover, Mars resources include materials that could be adapted to support human life, including air, fuels, fertilizers, building materials and an environment that could grow food.

There is a truism, but one that bears repeating, that the Universe doesn't care who explores it. It is we who care. And becaue we do, this epochal step in human exploration to a planet which could become a self-sufficient home for human beings, should be a cooperative international effort.

Indeed, given the enormous scope of such an effort, the resources required and its benefits to all mankind, it is tempting to say outright that it should be done unilaterally. Nevertheless, if the commitment and the resources were forthcoming, nothing would preclude a technologically sophisticated and dedicated nation from going it alone.

But whether a manned Mars mission should turn out to be a unilateral or a multilateral undertaking, one thing is clear. To make any sense, such a program must be viewed as a long-term commitment. It cannot focus merely on landing humans on the planet and returning them safely to Earth. A Mars landing must also include planning for subsequent sustaining operations. The first Mars explorers probably will not become permanent residents. Rather, they will set the stage for others to come. For others will come—to build, to live, to work, to learn and above all, to explore with their own hands, eyes, and tools this exciting and unknown world.

Mars has a special meaning as we look out into the Universe to plan our next steps in space in the post-Space Station era. It is attainable. It is livable. And

The surface of Mars photographed by the Viking 2 Lander.

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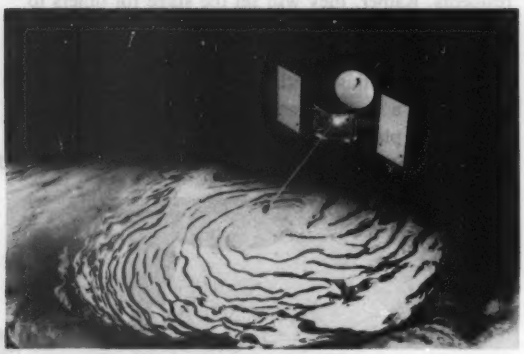
its major mysteries remain unsolved. Space-age exploration of the planet has revealed it as a kind of "halfway world", in part, like Earth and in part, like the Moon and Mercury. What caused its climate changes? How did its surface features—the great rifts and huge volcanoes—form? Is the whole planet really lifeless? If so, why, given that next to Earth, Mars has the best environment to sustain life in the solar system?

Mars has a thin atmosphere, climate, weather and apparently, huge reservoirs of frozen water. Like the Moon and Mercury, the ancient, cratered surface of its southern hemisphere is little changed over billions of years. It probably bears evidence of the solar system's formation.

In Mars' northern hemisphere, huge volcanic mountains climb as high as 25 kilometers—three times higher than Mt. Everest and up to six times higher than any volcano on Earth. Elsewhere on this younger half of Mars, there is a 2800-mile-long canyon stretching three times deeper and seven times longer than the Grand Canyon of the Colorado. In that canyon is probably locked the whole geological history of Mars and perhaps, equally important, clues to the history of our own star, the Sun.

So Mars is geologically interesting. But we can study planetary geology with unmanned spacecraft. Indeed, we have done so on Mars with several unmanned spacecraft. Some have flown by the planet. Others have orbited it. And two have landed on it. We will continue to explore the planet with unmanned spacecraft.



An artist concept of the Mars Observer in polar orbit. Scheduled for launch in the 1990's, the spacecraft will observe seasonal changes during an entire Martian year.

In 1990, for example, we expect to launch the Mars Observer, which will do global mapping of Mars for a full Martian year, which is equal to two Earth years. We will focus on geoscience and climatology.

Later, unmanned spacecraft will surely focus on other science missions—such as the planet's upper atmosphere, its magnetic field, its seismology. And more ambitious unmanned missions would, most likely, return Mars samples to Earth. We have already demonstrated the ability to learn about other worlds from moon rocks, from meteorites and from cosmic dust. We can now apply proven techniques to determine the nature and history of Mars from its own rocks.

Indeed, by studying Martian rocks and soil in a laboratory right here on Earth, we may even settle the question of whether there is or ever been Martian life.

If we can learn so much about Mars with our robot spacecraft, why would we want to go there ourselves? Would we go for the same reason we climb a mountain—because it is there? I doubt it. We would need broader reasons than that. Consider Bernard Shaw's line from "Methuselah: "Some men see things as they are and say, why; I dream things that never were and say, why not."

Why not go to Mars to advance the human presence in space?

Why not go to Mars to build a permanent gateway to the Asteroid Belt and the outer planets?

Why not go to Mars to use human judgment, human abilities, and human intelligence to explore an exciting new world? Why not go there to recognize, to describe, to organize, to correlate and to solve problems as only humans can solve them, using all our experience and skill?

On Mars, we could unleash all the richness and subtlety—all the variety and versatility of the human mind and spirit—to plumb the mysteries of who we are, how we came to be and what our destiny might be. So why not go to Mars to better understand ourselves and our Earth, our ice ages, the effects of our atmospheric changes on our weather and climate? And, in T.S. Eliot's words: "The end of all our exploring will be to arrive where we started and know the place for the first time."

Why not go to Mars to stimulate progress in our own space capabilities, to develop new cutting edge technologies—propulsion, life support, habitation, non-terrestrial resource use? These will not only get us to Mars, but also leave their benefits on Earth.

And, finally, why not go to Mars to build on the framework for international cooperation the Space Station will have begun and, perhaps, a manned lunar base will have continued?

An immensely challenging program such as a manned Mars mission could be a strong force for peace in the world. It could redirect creative human brains from the prospects of dealing with armed conflict to the prospects of planning and carrying out a peaceful, stimulating and ultimately more valuable program of unprecedented

scope and magnitude. Ironically, Mars, the primitive symbol of the God of War, could become a powerful instrument for peace.

"Humanity is just a work in progress," wrote Tennessee Williams. Indeed we are. And as we evolve and grow, I believe we will demonstrate that there are no limits to our future in the Universe.

Shakespeare understood that well. And, as usual, he put it best.

"Man is master of his liberty: . . .
There's nothing situate under heaven's eye
But hath his bound, in earth, in sea and sky,"

I believe that. There truly are no limits to what we can do if we have faith in the promise of the future.

Humans to Mars? Indeed, why not!

NASA Begins Simulated Airline Service Flights

The National Aeronautics and Space Administration will begin a series of simulated airline flights to operationally test new techniques to help smooth the air flow over aircraft wings.

Previous research has shown that smooth or laminar air flow can reduce aerodynamic drag from 25 to 40 percent under laboratory conditions and could provide significant fuel savings. However, in actual flight, laminar flow can be disrupted and disturbed by insects, ice, and other obstructions adhering to the leading edges of an aircraft's wings.

NASA's Ames-Dryden Flight Research Facility has installed on its business-sized JetStar aircraft two experimental laminar flow control devices incorporating techniques to help prevent leading edge contamination.

The simulated airline service flights will be flown in widely separated areas of the United States to experience a wide variety of contaminant conditions.

The JetStar will be based at various NASA installations and at commercial airports and will fly in and out of different airports to obtain information on various takeoff and landing situations that might affect the test articles. NASA will conduct the simulated airline service flights just as an airline would under normal air traffic rules and regulations.

While based at the different installations throughout the country, researchers plan up to four flights each day during a 2-week period to gather as much information as possible on performance of the test articles.

The two leading edge test articles, one installed on each wing of the JetStar, incorporate insect and ice protection with laminar flow control. Tests conducted on the JetStar in 1976 showed that the leading edge could be kept free of insects if it was kept wet while encountering them.

The test article installed on the left wing uses suction through 27 0.003-inch spanwise slots on the upper and lower surface to maintain laminar flow. A propylene glycol methyl ether (PGME)/water mixture is discharged through several slots at the wing leading edge and flows back over the wing for insect impact protection. This article was manufactured for NASA by Lockheed-Georgia.

The test article on the right wing uses suction through approximately 1 million 0.0025-inch diameter holes in the titanium skin to maintain laminar flow on the upper surface of the article. For insect impact protection, a shield is extended much like a wing leading edge flap on commercial transports. The shield is retracted at 6,000 feet altitude. Spray nozzles behind the shield can be used to spray the PGME/water mixture on the test article for additional insect protection.

For ice prevention during winter conditions, glycol is forced through the right wing's porous metal section of the shield leading edge in addition to the PGME/water spray. This article was manufactured for NASA by McDonnell-Douglas.

Since the simulated airline service flights are planned to approximate commercial flights as closely as possible, NASA officials are meeting with commercial airline officials to define what test conditions they would like to see flown and will incorporate the results of these discussions into flight planning. Researchers also are contacting entomologists in areas of the country that the JetStar will fly to determine the insect activity in each area.

The JetStar is configured as a "flying control room" with test instrumentation aboard. There are three consoles with data displays for researchers, who also have the ability to adjust the suction on the test articles if conditions warrant.

The JetStar will carry the Knollenberg probe, mounted atop the aircraft, to precisely measure the number and size of ice and water particles encountered in flight. A charge patch, located on the pylon that holds the probe, measures the static electric charge caused by particles in the air rubbing across the patch surface and gives a qualitative measure of ice and water particles. Correlation of the probe and patch data could calibrate the charge measurement in a simple cockpit display. Pilots could use the display to detect ice particles.

NSTL Satellite Technology Aids Disease Detection

Using satellite imaging technology to analyze complex body images is not a far-fetched idea where NASA is concerned. In fact, National Space Technology Laboratories scientists have been charged with the task of using NASA satellite imaging techniques to assist doctors in improving disease detection capability.

The project between NASA and the Mallinckrodt Institute of Radiology at the Washington University Medical Center in St. Louis, Mo., deals with a relatively new field of body scanning known as nuclear magnetic resonance or NMR.

According to Doug Rickman and Jim Anderson, two NSTL Earth Resources Laboratory scientists, NMR has been known as a physical phenomenon since the 1940s but only in the past 5 to 6 years has it been used as a diagnostic tool by physicians. As a result of its use, the medical profession has been able to view images of soft tissues in the body to aid in the diagnosis of disease in a way previously non-existent.

NMR scanning is an improvement over CAT SCAN, an X-ray technique sensitive to density of bone, in that the NMR is sensitive to soft tissue. To detect a brain tumor, an NMR image would be preferred over the CAT SCAN. Rickman says an X-ray usually will not stand a chance of detecting such a disorder.

The union between the space agency and Washington University was formed in 1980 to determine the applicability of NASA technology in analyzing NMR images, since the multispectral medical data is similar to multispectral satellite data. However, images produced from NMR data are normally black and white and not of the highest quality, which make them difficult to interpret.

According to Anderson, the images look much like an X-ray in their present form, and the doctors have been treating them as such while trying to make their diagnosis. He says the images are useful to the physicians in that format, but we are talking about a quantum leap using NASA image processing. Our purpose ultimately is to output a product which can be used by the physician to enhance or to finalize the diagnosis.

One step toward making the job easier on the physicians is to use the computer to enhance the images by assigning color values to the digital data. Preliminary color composites were made through the initial joint efforts of Kennedy Space Center and the University of Florida. Now NSTL's goal is to improve upon the enhanced color images, attempt to train the NMR scanner to be consistent in identifying like materials in the body and to assist in understanding how the unit can be used to its optimum potential.

Says Rickman, "The color images ease the physician's task which should make it more accurate in the long-run. It is quite difficult to intepret the black and white images but trivial to interpret the color ones."

In 2 days of "toying" with some NMR data, Anderson and Rickman say they were able to process a color image of a human brain which showed a distinct mass of tumor in its center. "The color composite was a notable advancement over the initial images," says Anderson. "Doug and I did that before we even got funded for the project just as an example of what could be done."

Enthusiasm at Washington University is high, according to the two NSTL scientists. Anderson states, "This application is obvious and immediately applicable. We know people are waiting for this to happen. They were going to wait until the second year of the project before obtaining our ELAS software system. But as it stands now they want to do it as soon as possible based on that one picture we sent them."

The project will last 3 years with Washington University providing the medical expertise and the data, KSC providing overall project coordination and funding, and NSTL providing the analytical capabilities.

Colladay Named to Aeronautics and Space Technology Post

Dr. Raymond S. Colladay has been appointed NASA Associate Administrator for Aeronautics and Space Technology, NASA Headquarters.

In his new position, Colladay is responsible for the overall management of the agency's aeronautics, space technology and terrestrial energy programs, including the institutional management of NASA's Ames Research Center, Mountain View, Calif.; Langley Research Center, Hampton, Va.; and Lewis Research Center, Cleveland.

Colladay was named Deputy Associate Administrator, Office of Aeronautics and Space Technology on April 18, 1982, and since April 17, 1985, has been serving as Acting Associate Administrator.

Colladay began his career with Lewis Research

Center in 1969, where he conducted analytical and experimental research in advanced, high temperature gas turbine engines. In 1974 he was named to head the Turbomachinery Fundamentals Section. He was then temporarily assigned to NASA Headquarters as acting chief of the Propulsion Branch in the Aircraft Energy Efficiency Office. In 1977, he was named assistant manager of the Lewis Energy Efficiency Engine project.

He returned to the Office of Aeronautics and Space Technology in 1979 as the deputy manager of the Advanced Propulsion Systems Office and later was manager for Propulsion Research and Technology. In 1981, he was named director of the Research and Technology Division.

Colladay received a bachelor's degree in 1965, a master's degree in 1966, and a Ph.D. in 1969 from Michigan State University, East Lansing, Mich. He has authored or co-authored more than 20 NASA technical reports and journal articles relating to aeronautical and space research.

Colladay and his wife, the former Judith K. Rief, reside in Reston, Va., with their two daughters.

"Astrotots" Simulate Shuttle Mission

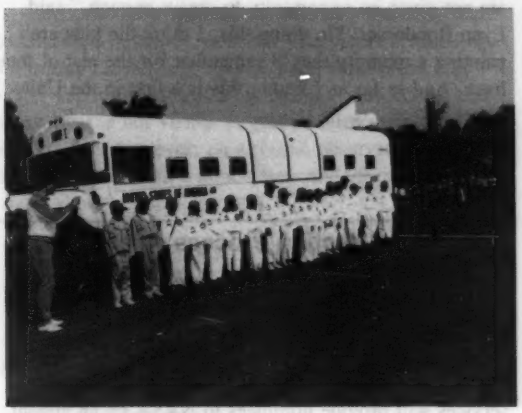
Leading to successful blastoffs at 0930 and 1000 hours on May 30, 18 brave astrotots boarded two specially equipped shuttle craft and embarked on unprecedented space flights that left both participants and observers starry-eyed. The mission: to explore unchartered territories in the "Partnerships in Education" program sponsored by the Lewis Research Center's Educational Services Office.

The 4-hour, 60-mile simulated space shuttle mission was part of a NASA Lewis-sponsored space science awareness program conducted with Midview (Southern Lorain County) and North Royalton school (Cuyahoga County) districts involving some 600 elementary students.

The simulated launch, first conceptualized by Educational Services Chief Lynn Bondurant, Jr., was an outgrowth of the 2-week "The Sky Is Your Classroom" workshop which Lewis sponsored last summer for 15 Belden and Royal View elementary teachers.

Before the much-awaited blastoff, 2 months of flight preparations were conducted. From the 249 third-, fourth- and fifth-graders who applied for the simulated flight, 36 astrotots (18 as alternatives) were chosen by teacher-directed selection committees to train for a variety of simulated mission roles: commander, pilot, photographer, communicator, medical team member, scientist, meteorologist, engineer, biologist and aerial technician.

The selected 18 astrotots, emerging in crisp white fitted paper uniforms, boarded two repainted and outfitted buses-turned-shuttles—Fantasy I and USS Belden-Midview Starship—each carrying a payload that included communications gear, computer, maps and metal detector.



Fantasy I and crew ready for flight.

In addition to collecting rock, soil, vegetation and water samples along their 35-mph trek, the crews conducted pupil-designed experiments. For example, one Belden flight experiment involved balancing a glass of water while walking in a straight line to test water reaction to movement as well as crew coordination.

Mission control operations were handled by MARS (Military Affiliated Radio Systems). Four MARS representatives conducted workshops to familiarize students with the set up and dismantling of mission control and operational procedures.

On launch day, four students per communication group worked as recorder, page, radio operator and P.A. announcer, each rotating in half-hour shifts. The communications teams were in direct contact with the shuttles and relayed messages of mission progress to students and guests.

When the shuttles reached the village green (city offices) at North Royalton, student aerial technicians, using a homemade robotic arm, released several helium balloon "satellites." And at the rendezvous and the landing sites, three types of kites, each differing in size and shape, were tested.

Following successful completion of their simulated shuttle flights, recorded by a dozen area news photographers and by a NASA video team for the

making of a documentary, the astronauts were checked out by a mission medical team and received a post-flight NASA debriefing.

Then an enthusiastic throng of students, guests and supporters cheered the victorious astrotots with a red-carpet welcome and a confetti-tossing parade and celebration. Pupils gave speeches and heard tape-recorded congratulations from Defense Secretary Casper Weinberger and astronaut Sally Ride.

"I really think, in today's educational system, kids are not given an opportunity to dream enough," said Lynn Bondurant. "In doing this, I think the kids are painting a memory they'll remember for the rest of their lives. And as far as I know, this is a first in the United States."

Astronaut Selection Process Altered

NASA has changed the way in which it solicits applications for astronaut positions.

Applications from civilians will be accepted on a continuing basis beginning Aug. 1, 1985. The military services will provide nominees to NASA on an annual basis. Selection usually will be made in the spring each year with successful candidates reporting in the summer.

The number of candidates selected each year will be determined by mission requirements and the attrition rate of the astronaut corps.

Both pilot and mission specialist astronauts will be selected. Pilot astronauts are responsible for control of the Space Shuttle during launch and entry and on-orbit maneuvers. Mission specialist responsibilities include management and operation of Space Shuttle systems and support to payloads and experiments during flight.

Minimum qualifications for pilot astronauts are:

— A bachelor's degree from an accredited institution in engineering, physical science, biological science or mathematics.
— 1,000 hours pilot-in-command time in jet aircraft.
— Ability to pass a NASA Class I flight physical.
— Height between 64 and 76 inches.

Minimum qualifications for a mission specialist astronaut are:

— A bachelor's degree from an accredited institution in engineering, physical science, biological science or mathematics.
— Degree must be supplemented by 3 years of related professional experience. Advanced degrees are desirable and may be substituted for experience.
— Ability to pass a NASA Class II flight physical.
— Height between 60 and 76 inches.

NASA has an affirmative action goal of including qualified minorities and women among newly-selected astronauts.

DeCair Named Associate Administrator for External Relations

Thomas P. DeCair has been appointed Associate Administrator for External Relations, NASA Headquarters.

In this position, DeCair will be responsible for policy level management, direction, and coordination of the agency's relationships with public and private organizations both domestic and international. This includes the news media, other federal agencies, state and local governments, industry, and private individuals.

He also will be the principal advisor to the NASA Administrator and other senior officials on matters pertaining to NASA's external relations activities.

DeCair comes to NASA from the U.S. Department of Justice where he served from February 1981 as Director of Public Affairs and Special Assistant to the Attorney General. In his dual positions, he served as chief spokesman for the Justice Department and played a key role in the Attorney General's program which emphasized international cooperation in combating organized crime and drug trafficking.

Born in Spartanburg, S. C., DeCair was raised in Michigan. He attended Kalamazoo College and was a reporter for the Kalamazoo Gazette and the Holland Evening Sentinel. Following U.S. Army service, he attended Hope College in Holland, Michigan where he was elected to Phi Beta Kappa as a junior and received his B.A. degree magna cum laude in January 1972.

After graduation, DeCair was Staff Assistant in the White House Press Office and then Assistant Press Secretary to Presidents Nixon and Ford.

He became Executive Assistant to Michigan Governor William Milliken in 1975, president of a Kalamazoo advertising agency in 1977, and vice president of a Troy public relations firm in 1978. He coordinated the 1977

National Governors' Conference while working for Governor Milliken.

DeCair and his wife, the former Sheila M. Cook, have three children and reside in Washington, D.C.

NASA Exhibits at EAA Convention

One highlight of the Annual EAA International Fly-in and Sport Aviation Exhibition, to be held July 26 to August 2 in Oshkosh, Wisc., is the presence of the National Aeronautics and Space Administration. The theme of NASA's exhibit this year is "The Shape of Things to Come".

In a departure from exhibits of past years, NASA's 1985 displays have been broadened from strictly aeronautics to include a greater representation of its activities in space technology. A 60-by-90-foot tent will house displays of the agency's research and technology development work in aeronautics, the Space Station, the Space Shuttle, and space exploration.

Ames Research Center and Langley Research Center will provide aeronautics exhibits. Lewis Research Center will provide aeropropulsion and space exhibits.

In addition, Goddard Space Flight Center will have its Search and Rescue Satellite van on hand. Johnson Space Center and Marshall Space Flight Center will exhibit material on space research.

Aeronautics

NASA's current activities in small engine aeropropulsion systems, advanced turboprops, stall-spin and aerodynamics research, de-icing, advanced structural materials, simulation and human factors research, and advanced tactical aircraft design will be featured as part of its aeronautics exhibit.

Space Station

Exhibits on the Space Station will explain how America's "next logical step" in space exploration will serve as a base for scientific, technological, and commercial advances.

Space Shuttle

Operating from subsonic to hypersonic (Mach 6 plus) speeds in a flight environment never before experienced by a winged vehicle, the Space Shuttle Orbiter is a unique test bed for a series of experiments that will provide design data for future transatmospheric vehicles.

Shuttle exhibits will explain the gathering of data on atmospheric conditions, re-entry angles of attack, sideslip, the chemical make-up of gases on the orbiter surfaces during re-entry, aerodynamic heating on the upper surfaces of the orbiter during re-entry, and the chemical reaction of air molecules near the surfaces of the orbiter caused by the re-entry shock waves.

Space Exploration

Exhibits in this area will cover two major steps in NASA's exploration of the solar system: Galileo, which will amplify earlier findings about the planet Jupiter, and Ulysses, which will orbit the polar regions of the Sun. Both are scheduled for launch in 1986.

Another exhibit will explain NASA's use of aircraft as telescope-equipped, airborne observatories, focusing on infrared astronomy. The Earth's atmosphere and water vapor absorb and filter infrared radiation so that much of it is not visible to ground telescopes. At 41,000 feet, however, an airborne observatory is above 85 percent of Earth's atmosphere and 99 percent of its water vapor.

Allen Leaves NASA

Dr. Joseph P. Allen, mission specialist astronaut and former Assistant Administrator for Legislative Affairs, resigned from NASA July 1, 1985 to become executive vice president of Space Industries, Inc., a Houston-based firm pursuing commercial ventures in space.

In November 1982, Allen was a mission specialist on STS-5, the first fully operational flight of the Space Shuttle. During that mission, Allen participated in the deployment of two communications satellites. Two years later, he flew on mission 51-A, participating in the deployment of another two communications satellites and, in the first space salvage mission, helped successfully retrieve the Palapa B-2 and Westar VI satellites for return to Earth.

Additionally, Allen served as a mission scientist for Apollo 15, staff consultant on science and technology to the President's Council on International Economic Policy, and NASA Assistant Administrator for Legislative Affairs. He is the author of "Entering Space: An Astronaut's Odyssey," a personal account of spaceflight experience.

Allen has been awarded the NASA Exceptional Scientific Achievement Medal, the NASA Exceptional

Service Medal, a NASA Superior Performance Award, an honorary Doctorate of Science from DePauw University and the Komarov Diploma from the Federation Aeronautique Internationale.

Inside NASA

Malfunction Lab Assists In Problem Solving

Before you can correct the problem, you have to locate it, and that's where the Kennedy Space Center's Malfunction Analysis Laboratory comes into play.

From the smallest micro-electronic chips to the Space Shuttle Orbiter, KSC's malfunction lab assists in determining the origins of many types of electronic, metallurgical, and mechanical malfunctions.

Using state of the art equipment, the seven members of the malfunctions analysis team examine failed materials and usually determine the point and cause of a breakdown. According to Branch Chief Bob Denaburg, the lab completes between 275 and 300 requested analyses from NASA and NASA contractors each year.

Recent work completed by the lab includes an analysis to determine the cause of failure of the Space Shuttle's external tank hydrogen vent arm's shock absorbing system and examination of the pan and tilt functions in cameras that cover the launches.

The malfunctions team consists of electrical, mechanical, aeronautical, metallurgical, and aerospace engineers, a physicist, and a senior meterologist. According to Denaburg, "We are a team, all of the disciplines talk with one another—it's definitely a team effort."

The lab is divided into three distinct sections each having its own specialty. One division primarily concerns itself with metals and metal failures, while the others focus on electronics and mechanics.

The metallurgical lab determines the exact cause of metal failures. Through an organized process of polishing, etching, and intense microscopic examination, lab technicians can determine the grain of a metal and locate any potential problems in the metal. Denaburg said that most metal failures at the Kennedy Space Center are the result of corrosion caused by the hostile marine air environment.

In analyzing electronic malfunctions, technicians use high-powered microscopes capable of multiplying a single computer chip up to 600 times, or they can use a scanning electron microscope capable of multiplying a single chip to thousands of times its normal size. Using such a high magnification, technicians can follow the circuit and determine the exact point of malfunction.

Fluid mechanics techniques locate malfunctions with the assistance of a wide range of instruments. A large x-ray machine allows technicians to view the actual working functions of many mechanical and electro-mechanical devices. The lab also contains a "clean room" to examined items already precision-cleaned for space flight.

The senior meterologist conducts scientific-oriented analyses on assembled components, using machinery accurate to within 2 10,000ths of an inch. By using such a system, he can determine the exact point of a breakdown in a component assembly.

According to Denaburg, the lab is busiest during shuttle pre-launch preparation periods. Malfunctioning components are sent to the lab for analysis to determine the cause of failure. During this period, the lab technicians are on call 24-hours a day. If any failure has the potential of affecting launch, the lab guarantees a 5-hour verbal reply time on malfunction inquiries.

Denaburg said that contractors, whose products are being examined, are encouraged to visit the lab for discussions and to view the actual analyses. Only malfunctions lab personnel, however, are allowed to take a "hands-on" role in the actual analysis.

Finally, the lab provides a thoroughly documented portrayal of the malfunction analysis including photos, x-rays, and test and analyses results from which a hypothesis and if possible, a verification of breakdown may be reached.

NASA's First Historian Dies

Dr. Eugene M. Emme, first historian of NASA, died in late June. Dr. Emme was the organizer and guiding light in the creation of the NASA History Office and its historical publications program.

He was the founding chairman of the history committees of the National Space Club, the American Institute of Aeronautics and Astronautics, and the American Astronautical Society and became co-chairman of the history committee of the International Academy of Astronautics while serving as a delegate to international congresses in Paris, Warsaw, Madrid, Contance, and Moscow.

Dr. Emme was the author of The Impact Of Air Power, The History of Rocket Technology, A History of Space Flight, and Two Hundred Years of Flight in America.

He was born in Evanston, Illinois on November 3, 1919. He graduated from Morningside College, Sioux City, Iowa in 1941 and received his Ph.D. in Modern European History at the University of Iowa in 1949. He was a pilot and a naval aviator. He transferred to the U.S. Air Force Reserve in 1948, retiring from the Ready Reserve in 1972 as a Colonel. He joined NASA in 1959.

He is survived by his wife, Ruth Rance Emme, sons Stephen and Stuart of Silver Spring, Maryland, daughter Sandra of Largo, Maryland, his mother Ada Emme of Lakeland, Florida and two grandchildren.

Independence Joins NASA Fleet

The newest solid rocket booster retrievel ship, the Independence, has arrived for duty. The ship, owned by the U.S. Air Force, is specifically designed for retrieval of expended boosters after Space Shuttle launches from Vandenburg Air Force Base, Calif. (VAFB).

The ship will be outfitted with retrieval gear and verified at KSC, before cruising to its home, Port Hueneme, Calif., about 107 miles south of VAFB.

Independence will be the mother ship for west coast booster retrievals, towing one of the boosters and providing room for the majority of the crew, the six main parachutes from both boosters and both frustums. The ship's first booster retrieval will be mission 51-F, set for launch no earlier than July 15. Another smaller ship will be leased to tow the other booster and carry the remainder of the 42-member retrieval crew.

Independence, built by Halter Marine in Moss Point, Miss., is larger than its sister retrieval ships, the Liberty Star and the Freedom Star. Independence is 199 feet long and has a beam of 40 feet. The Freedom and Liberty ships are 176 feet long and have beams of 37 feet.

The Independence has both fore and aft water jet thrusters, making it highly maneuverable. The other two ships have stern thrusters only. Independence's top speed is about 13 knots. Enought supplies can be carried for a 30-day voyage.

Shuttle solid rocket boosters splashdown in a target area of about 7 miles by 10 miles. The casings carry radio signaling devices that allow the ship to home in on their locations.

The Independence arrives at KSC.

The main parachutes are the first items retrieved. Their lines are wound onto the ship's reels.

The drogue parachute is reeled in the same way until the frustum is approximately 100 feet from the ship. Then the chute's shroud lines are wound in until the frustum can be hoisted from the water by a 64-foot deck crane capable of lifting about 9,000 pounds.

The final step requires divers to insert a water displacing device inside the casings, which are floating vertically. The casings then rise for horizontal towing.

Spent boosters will be disassembled at the Port Hueneme facility. The parachutes and the forward and aft skirts will be shipped to KSC for refurbishment. The spent booster casings will be shipped to Morton Thiokol in Utah.

Commercial Development Center Candidates Named

NASA Administrator James M. Beggs has announced the 21 teams which submitted proposals to establish Centers for the Commercial Development of Space.

The objective of these centers will be to stimulate high technology research in the microgravity environment of space. This research eventually will lead to the development of new products which either have commercial potential or contribute to possible commercial ventures.

The research areas proposed include semiconductor crystal growth, remote sensing, communication technology and biotechnology.

NASA's Office of Commercial Programs received proposals from industry/university consortiums in response to a program solicitation. Proposals were received from:

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- ★ **Battelle-Columbus Laboratories,** Columbus, Ohio.
- ★ **The Institute for Technology Development,** Jackson, Miss.
- ★ **Colorado School of Mines,** Golden, Colo.
- ★ **Vanderbilt University,** Nashville, Tenn.
- ★ **University of Florida,** Gainesville, Fla.
- ★ **MIT,** Cambridge, Mass.
- ★ **Midwest Research Institute,** Kansas City, Mo.
- ★ **University of Alabama,** Birmingham, Ala.
- ★ **University of Tennessee Space Institute,** Tullahoma, Tenn. (2 proposals)
- ★ **University of Alabama,** Huntsville, Ala.
- ★ **Institute of Space Research,** Houston, Tx.
- ★ **Polymer Research Institute,** Amherst, Mass.
- ★ **Earth Data Corp.,** Stanford, Calif.
- ★ **Georgia Tech Research Corp.,** Atlanta, Ga.
- ★ **The National Technological University,** Fort Collins, Colo.
- ★ **University City Science Center,** Philadelphia, Penn.
- ★ **Center for Technology Development,** Albuquerque, N. Mex.
- ★ **University of Virginia,** Charlottesville, Va.
- ★ **Virginia Polytechnic Institute,** Blacksburg, Va.
- ★ **Northeastern University,** Boston, Mass.

Did You Know?

Twenty-six Virginia high school students spent 6 weeks at the Langley Research Center this summer performing "real life" science and engineering tasks under the direction and guidance of NASA mentors.

Seventeen boys and nine girls participated in the Governor's School for the Gifted. These students possessed a high level of ability in mathematics and science and have demonstrated outstanding achievement in these areas.

Approximately 700 students from across the state are nominated for the Governor's School programs hosted at various state colleges and universities. From the 700 nominees, 450 are selected to participate in the summer experience, 125 of them assigned to the program hosted by Langley. Selections are based on grade point average, extracurricular activities, teacher recommendations and a written paper.

This was the fourth summer Langley has served as a host to the Governor's School, sponsored by the Virginia Department of Education. The program offers exploration to bright students who are considering careers in science or engineering.

NASA and the U.S. Army Aviation Research and Technology Activity-AVSCOM will sponsor a 1-day symposium September 30 honoring 20 years of cooperative research between NASA and the U.S. Army. The symposium will be held at NASA's Ames Research Center.

The symposium will feature distinguished speakers and guests, a tour of major aeronautical facilities and an opportunity to view flight research aircraft including the NASA/Army XV-15 Tilt Rotor Research Aircraft and the Rotor Systems Research Aircraft. Speakers will include congressional representatives and senior NASA and Army management.

NASA tested technology developed by the Coca-Cola and Pepsi-Cola Co. to dispense carbonated beverages in space on mission 51-F. Until then it was not possible for astronauts to consume carbonated soft drinks in the microgravity environment of space because there was no adequate way to dispense carbonated beverages. The new technology provided an alternative source of liquid consumption for astronauts. Both companies developed their dispensing cans at their own initiative and expense. NASA also received the technical information necessary to fabricate its own cans for use in space.

The first NASA Headquarters building in Washington, D.C. was originally intended to be a residential home not an office building. Built in 1830, many famous people lived in the house before it became NASA Headquarters from 1958 to 1961. Dolly Madison Payne, wife of President James Madison, lived there. Then it was called the Dolly Madison House. The Wright brothers stayed there after the building was converted into a club for Washingtonians. The house was torn down to make room for a new government building in 1962.

Heard From Around the World

(from non-NASA sources)

TOKYO—The Japanese Science and Technology Agency and the National Space Development Agency have revised the Space Development Plan due to the delayed launching of an applications broadcast satellite.

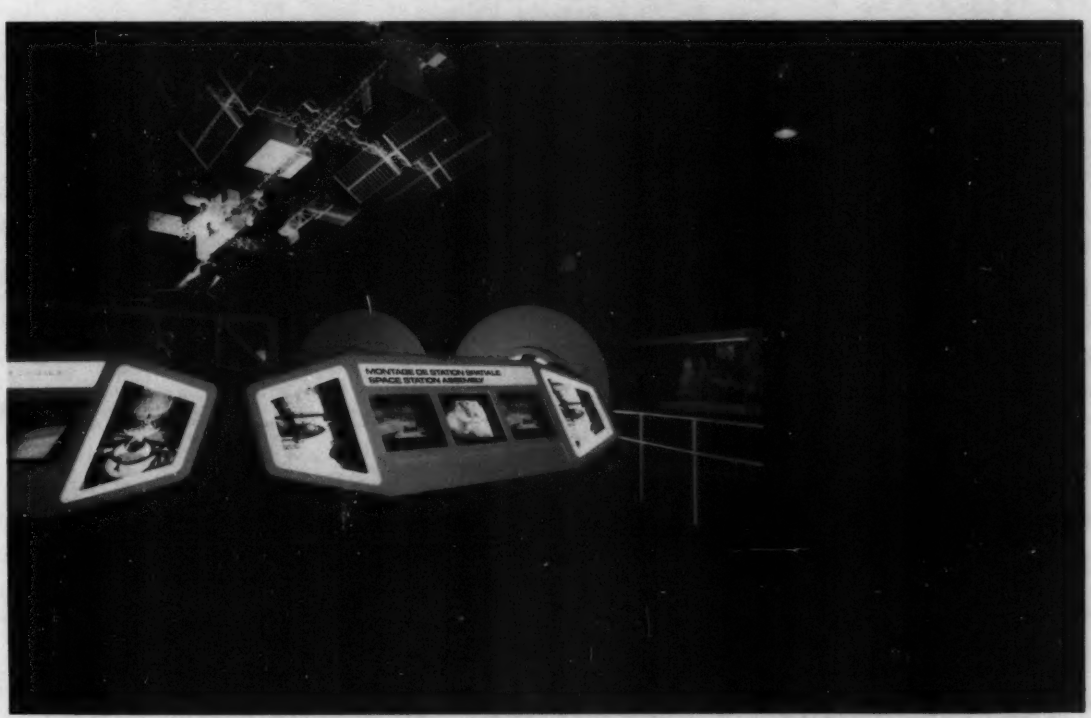
Launches to be postponed by 6 months include the H-1 experimental rocket, the first Maritime Observation Satellite, and the H-1 experimental reserve rocket originally scheduled for launching in the winter of 1986, the summer of 1987, and the winter of 1987, respectively.

FRANCE—A Sino-French space technology cooperative agreement has been signed by officials of the Chinese Ministry of Astronautics Industry and the French National Space Study Center.

Cooperation includes production of ground-observation satellite platforms and associated photo processing, linkup of satellite and controlling stations, and production of carrier rocket components.

CHINA—The Ministry of Astronautics Industry reportedly has said that China is ready to accept orders from foreign nations for Chinese satellites, carrier rockets, ground stations, and associated services. The Ministry added that China is capable of manufacturing and launching space shuttles and carrying out space travel programs.

TOKYO—Japanese Posts and Telecommunications Ministry announced plans to launch a 2-ton, advanced communications technology satellite in the 1992 period. The satellite will be designed jointly by the Japanese government and Nippon Telegraph and Telephone Corporation to demonstrate advanced technologies.



The Paris Air Show, held May 31-June 9, was a major international showcase for the world's aerospace industry. Themed "Living, Learning, and Working in Space", the NASA exhibit highlighted significant areas of space and aeronautics technologies including the Space Telescope, the X-29 aircraft, a full scale Space Shuttle model and designs of the Space Station living modules. Over 150,000 people visited the NASA exhibit.

Contractor News

NASA Lewis Research Center has awarded a $14,900,000 contract to **Honeywell Inc., Avionics Div.,** Clearwater, Florida, for fabrication and delivery of three flight inertial measurement groups (IMG) to be used in support of the Shuttle/Centaur program.

The IMG, which is an integral part of the guidance and navigation system for Centaur, maintains a fixed reference orientation regardless of vehicle movement and measures vehicle acceleration.

The sole-source, firm-fixed-price contract will begin in May 1985 and end in December 1987. Work will be performed at the contractor's plant in Clearwater, Florida.

NASA's Marshall Space Flight Center has awarded a 3-year, $35,181,700 contract to the **Space Transportation Systems Division of Rockwell International,** Downey, Calif. for Space Shuttle systems integration work. The period of performance is from July 1, 1985 to June 30, 1988.

Under the contract, Rockwell will provide management, personnel, equipment, materials and resources required to provide systems integration to the Space Shuttle program at the Marshall Center. Work also will be performed at the Kennedy Space Center, Fla., Vandenberg Air Force Base and Downey, Calif.

The Marshall Center is responsible for the Space Shuttle's propulsion system, which includes the main engines, solid rocket boosters and external tank.

Coordinators of NASA Employee Teams (NETS) were unanimously enthusiastic about the recent success of pilot projects at their installations both in terms of team member participation and increased top management support.

The Centers have succeeded in increasing the number of science and engineering teams as well as those in most other white collar areas. One new category, designated supervisor/manager, is designed to improve work processes within or among units which have frequent interfaces.

As a group, the NETS coordinators emphasized benefits in increased work group effectiveness, personal growth of team members as well as other improvements associated with NET activities.

Participants at the most recent NETS meeting include (seated) Mary Kovach, LeRC; Tori Clavert, ARC; Alma Martin, JSC; Chris Dreyfuss, Martin Marietta Corp (MMC); Valerie Thomas, GSFC; and Marcia Nickols, HQ and (standing) Bill Reynolds, MSFC; Walt Baleyko, KSC; Skippy Cole, LaRC; Gene Bishop, KSC; Betsy Sirk, HQ; Steve Rohr, MSFC; Gus Orfan, MMC; Joyce Jarrett, HQ; Jan Moore, HQ; Ron Carter, NSTL; Marilyn Gist, GSFC; Leo Lunine, JPL; Dale Crossman, HQ; Ralph Tortorich, MMC; Don Carr, MMC.

1985 Shuttle Launch Schedule

Mission	Date/ Orbiter	Payloads	Crew
51-I	Aug. 24, 1985 *Discovery*	Syncom IV-4 ASC-1 Aussat-1	Engle, CDR Covey, PLT Van Hoften, MS Lounge, MS W. Fisher, MS
51-J	Oct. 1, 1985 *Atlantis*	DOD	Bobko, CDR Grabe, PLT Hilmers, MS Stewart, MS Mullane, MS
61-A	Oct. 30, 1985 *Challenger*	Spacelab-D1	Hartsfield, CDR Nagel, PLT Buchli, MS Bluford, MS Dunbar, MS Furrer, PS (DFVLR) Messerschmid, PS (DFVLR) Ockels, PS (ESA)
61-B	Nov. 27, 1985 *Atlantis*	Morelos-B Satcom KU-1 Aussat-2 CFES	Shaw, CDR O'Connor, PLT Cleave, MS Spring, MS Ross, MS Vela, PS (Mex.) McDonnell Douglas PS
61-C	Dec. 20, 1985 *Columbia*	MSL-3 Satcom KU-2 Syncom IV-5	Gibson, CDR Bolden, PLT Chang-Diaz, MS Hawley, MS Nelson, MS RCA PS

1985 Expendable Launch Schedule

Mission	Launch Date	Vehicle	Launch Site
Navy-22	Aug. 2	Scout	WSMC
Intelsat VA-D	Sept. 26	Atlas Centaur	ESMC
AF-16	Sept.	Scout	WFF
AF-17	Oct.-Dec.	Scout	WFF
NOAA-G	Nov.	Atlas	WSMC
GOES-G	Dec.	Delta	ESMC
Navy-23	Dec.	Scout	WSMC

Another Dividend from Air and Space

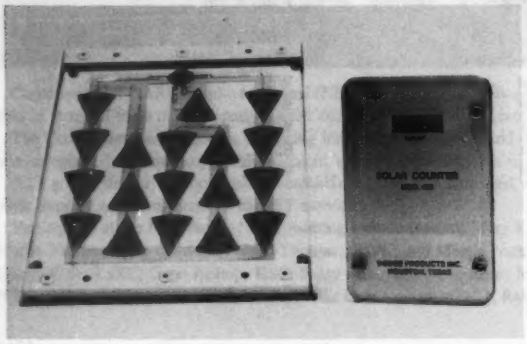
Research and development in aeronautics and space have provided numerous benefits for all Americans—and at a tiny percentage of the tax dollar. Here is an example:

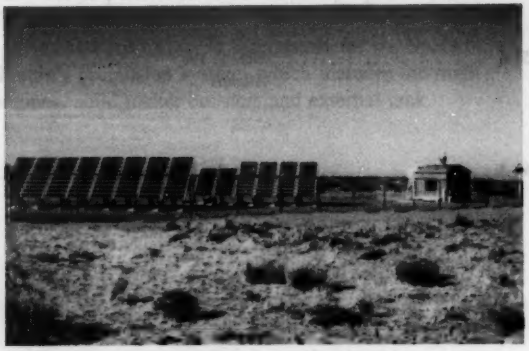
Solar Energy Systems

Below is a new device known as the Solar Counter. Calibrated in kilowatt hours per square meter, it provides a numerical count of the solar energy that has accumulated on a surface. Power and sensing for the device are provided by the remotely-located small solar panel shown at the left of the counter. The sensor is weatherproof and may be permanently located out doors. Counting will continue even on cloudy days to provide an accurate value of the total accumulated solar radiation.

The Solar Counter is the latest in a line of solar energy sensing, measuring and recording devices produced by Dodge Products, Inc., Houston, Texas. They incorporate solar cell technology developed by the Lewis Research Center, which has conducted extensive research on solar cells for space applications. Lewis also manages for the Department of Energy, a project intended to build a market for solar cells by demonstrating their advantages in practical Earth-use applications.

Dodge products was formed to bring this photovoltaic technology to the commercial marketplace. Its customers for the various devices include architects, engineers and others engaged in construction and operation of solar energy facilities. Manufacturers of solar systems or solar-related products, such as glare reducing windows and solar energy planners in federal and state government agencies also use the technology.





Among other products in the Dodge line are the Portable Solar Meter used to estimate the performance of solar arrays, lenses and mirrors, the Solar Integrator an instrument for automatic measuring, computing and recording the amount of solar energy that has fallen on a surface for periods up to 9 months, and the Solar Sensor, a weatherproof system that senses solar radiation and sends input signals to the Solar Integrator.

The latter two devices are used, for example, to check the efficiency of solar arrays, such as the one pictured at top, an installation that provides cathodic protection for the 12" Four Corners Pipe Line Company, a subsidiary of ARCO Transportation Company, Independence, Kansas. Cathodic protection involves impressing a DC current, generated by the solar array, on the pipe line to protect the pipes against corrosion. The solar array is one of four installed by ARCO to replace diesel-powered electricity generating units, which required considerable maintenance and constant care. Located near Farmington, New Mexico, ARCO's initial solar array has operated successfully without interruption for more than 4 years.

* NASA does not endorse commercial products developed as a result of its Technology Utilization or Patent Licensing Programs, but it does encourage the widest possible use of its technology.

*U.S. GOVERNMENT PRINTING OFFICE: 1985-461-600:20001